



CANINE DIAGNOSIS: WHAT IS THE TEST TELLING US?

Susan E. Little, DVM, PhD, Dipl. EVPC



Dogs as Sentinels



- People and dogs susceptible to infection with and disease from many of the same tick-borne pathogens
- Due to lifestyle and tick exposure, dogs likely to be infected
- Testing dogs for tick-borne infections common in veterinary medicine
- Canine infections can serve as bellwether for infection risk in people

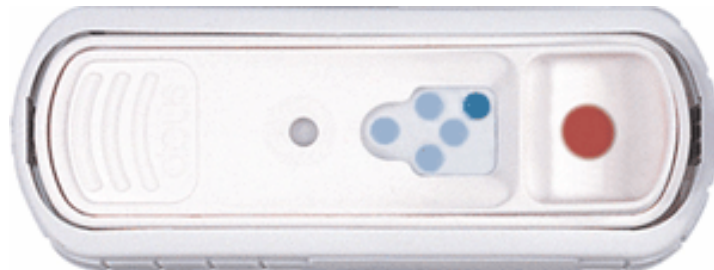
Ticks on dogs

- intense infestations common in absence of control
- readily mitigated by routine acaricide use and habitat/lifestyle management



Canine testing

- Routine, annual testing of dogs for *Dirofilaria immitis*
 - ▣ often coupled with testing for antibodies to *Ehrlichia*, *Anaplasma*, *Borrelia burgdorferi*
 - ▣ also test when suspect clinical disease



Canine tick-borne disease agents in the United States

Lyme disease/Lyme borreliosis

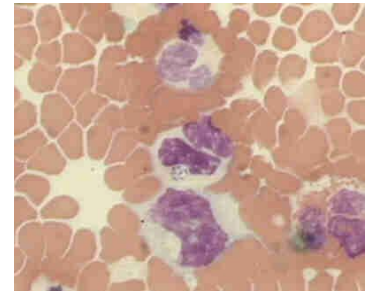
Borrelia burgdorferi



Ehrlichiosis/Anaplasmosis

Ehrlichia canis, *Ehrlichia ewingii*, *Ehrlichia chaffeensis*

Anaplasma phagocytophilum, *Anaplasma platys*

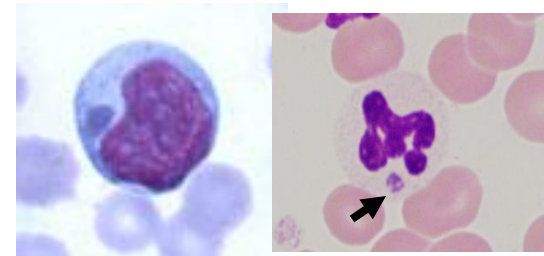
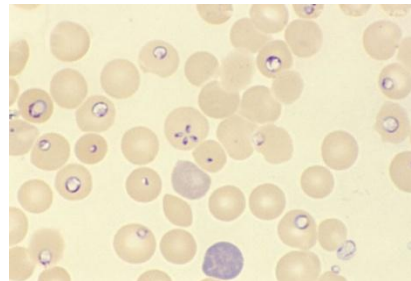


Rocky Mountain spotted fever

Rickettsia rickettsii

Babesiosis

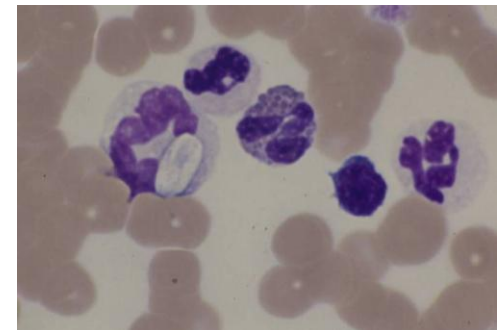
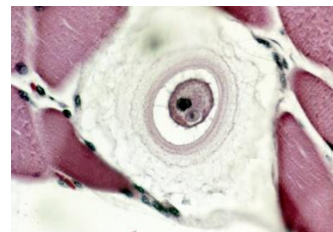
Babesia canis, *Babesia gibsoni*



Canine hepatozoonosis

Hepatozoon americanum

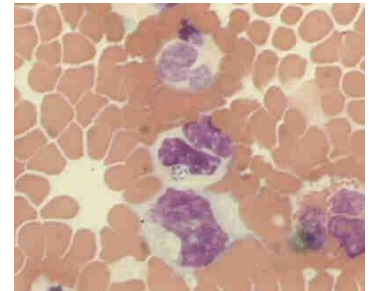
Hepatozoon canis



Canine tick-borne disease agents in the United States

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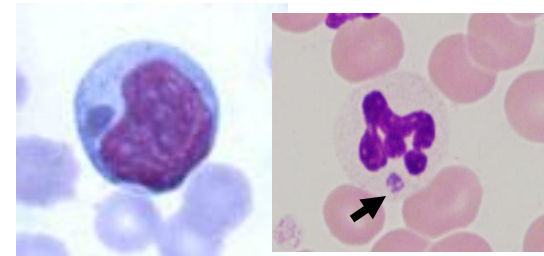
Ehrlichiosis/Anaplasmosis

Ehrlichia canis, Ehrlichia ewingii, Ehrlichia chaffeensis

Anaplasma phagocytophilum, Anaplasma platys

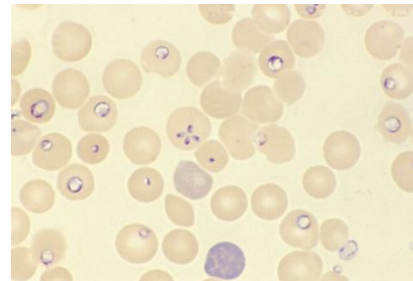
Rocky Mountain spotted fever

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Babesiosis

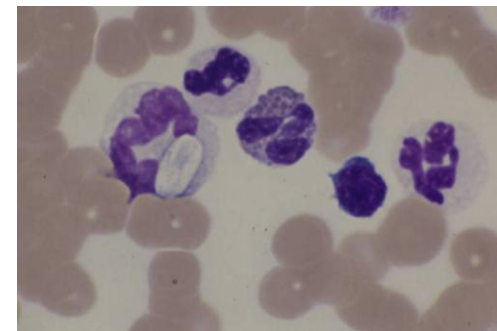
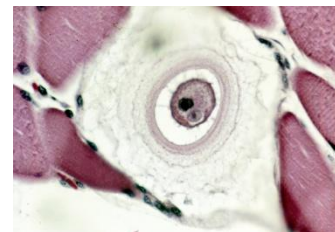
Babesia canis, Babesia gibsoni



Canine hepatozoonosis

Hepatozoon americanum

Hepatozoon canis



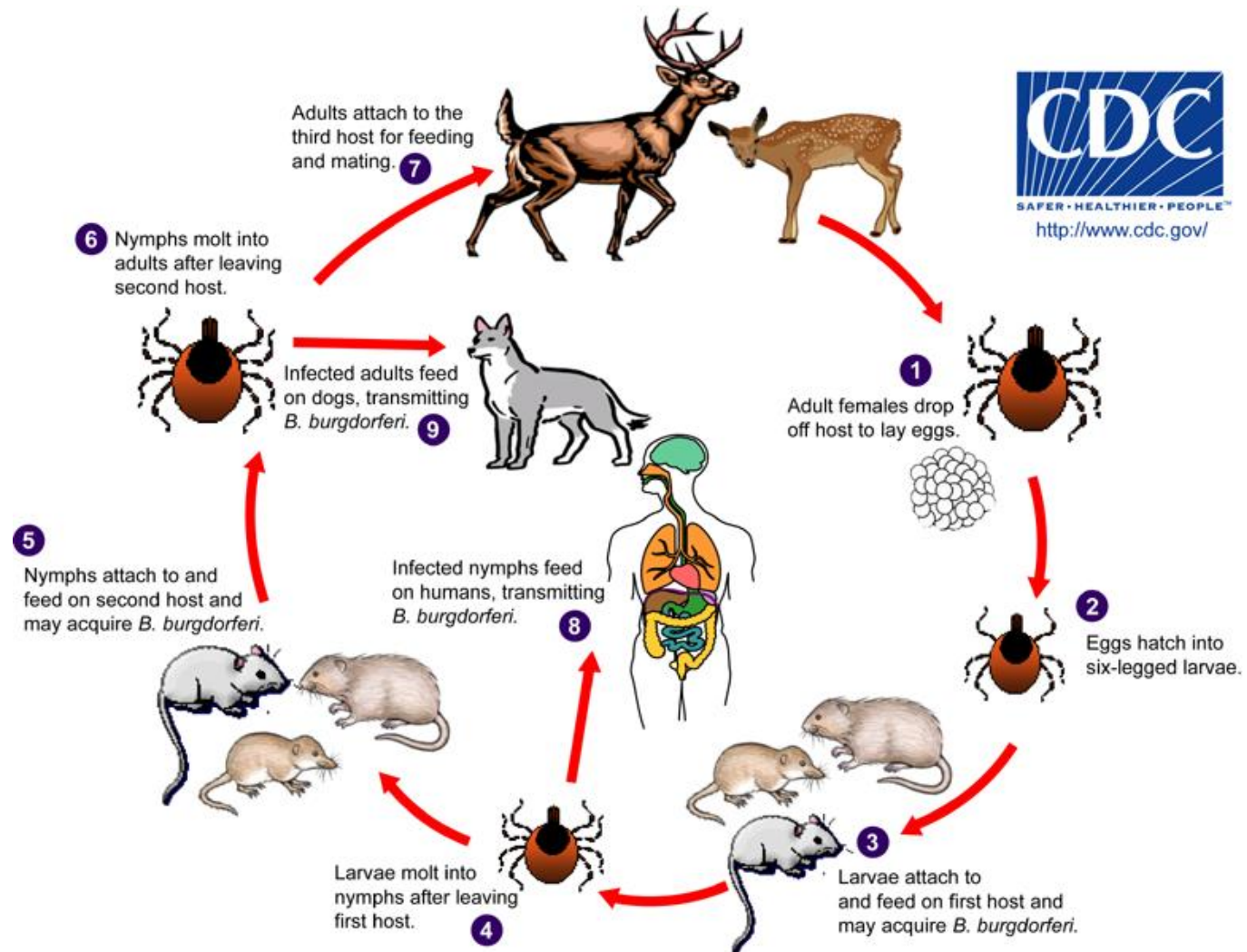
Expanding range of tick species

- introduction of new species
- spread of existing species into new areas
 - ▣ habitat modification
 - biogeographical changes
 - change in hydrology
 - ▣ increasing reservoir host population
 - white-tailed deer
 - other wildlife
 - ▣ cultural factors
 - decreased environmental pesticide application
 - wetland restoration
 - increased human contact with natural areas (recreation, occupation)

Dense tick populations



Lyme borreliosis



Lyme borreliosis

- infection common in dogs and people in endemic areas
 - ▣ differ in presentation, severity, treatment
 - ▣ canine vaccines widely available and used
 - ▣ preferred diagnostic test in dogs = C₆ assay
 - qualitative and quantitative assays available

Review



Special Issue: Zoonoses of people and pets in the USA

Lyme borreliosis in dogs and humans in the USA

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² College of Veterinary Medicine, Auburn University, Auburn, AL 86849, USA

³ Infectious Diseases Section, Department of Internal Medicine, Gundersen Lutheran Health System, La Crosse, WI 54601, USA

⁴ Division of Vector-Borne Infectious Diseases, Centers for Disease Control and Prevention, Fort Collins, CO 80521, USA

Reliance on C6-based assay

- ❑ widely available point-of-care test
- ❑ exquisite specificity
 - ▣ not vaccinated dogs
 - ▣ not other *Borrelia* spp. in North America
 - ▣ avoid interpretation issues in traditional two-tier approach
- ❑ dogs seropositive when develop clinical disease
- ❑ follow with quantitative C6 ELISA
 - ▣ track response to treatment



Testing in human medicine

- two-tier still widely practiced and endorsed
 - ▣ whole cell ELISA or IFA → Western blot
 - ▣ interpretation can be problematic

EDITORIAL COMMENTARY

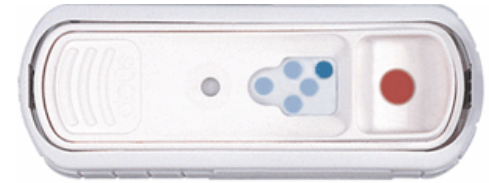
Laboratory Testing for Lyme Disease: Time for a Change?

Arthur Weinstein

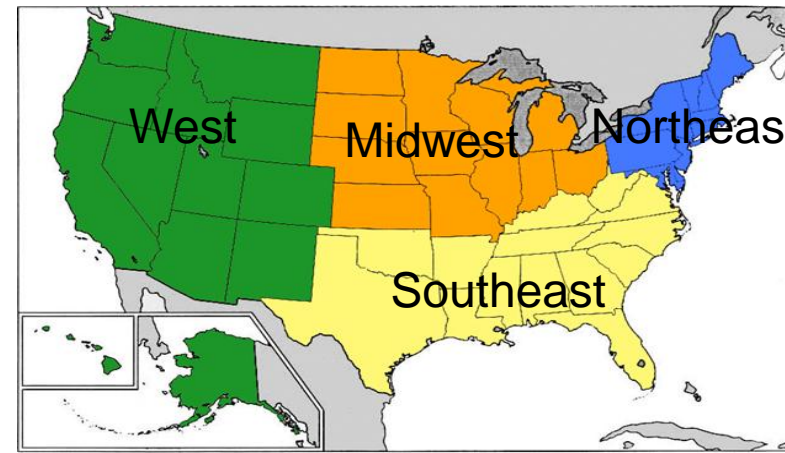
Department of Medicine and Division of Rheumatology, Georgetown University School of Medicine, and Department of Medicine, Section of Rheumatology, Washington Hospital Center, Washington, DC

(See the article by Steere et al. on pages 188–95)

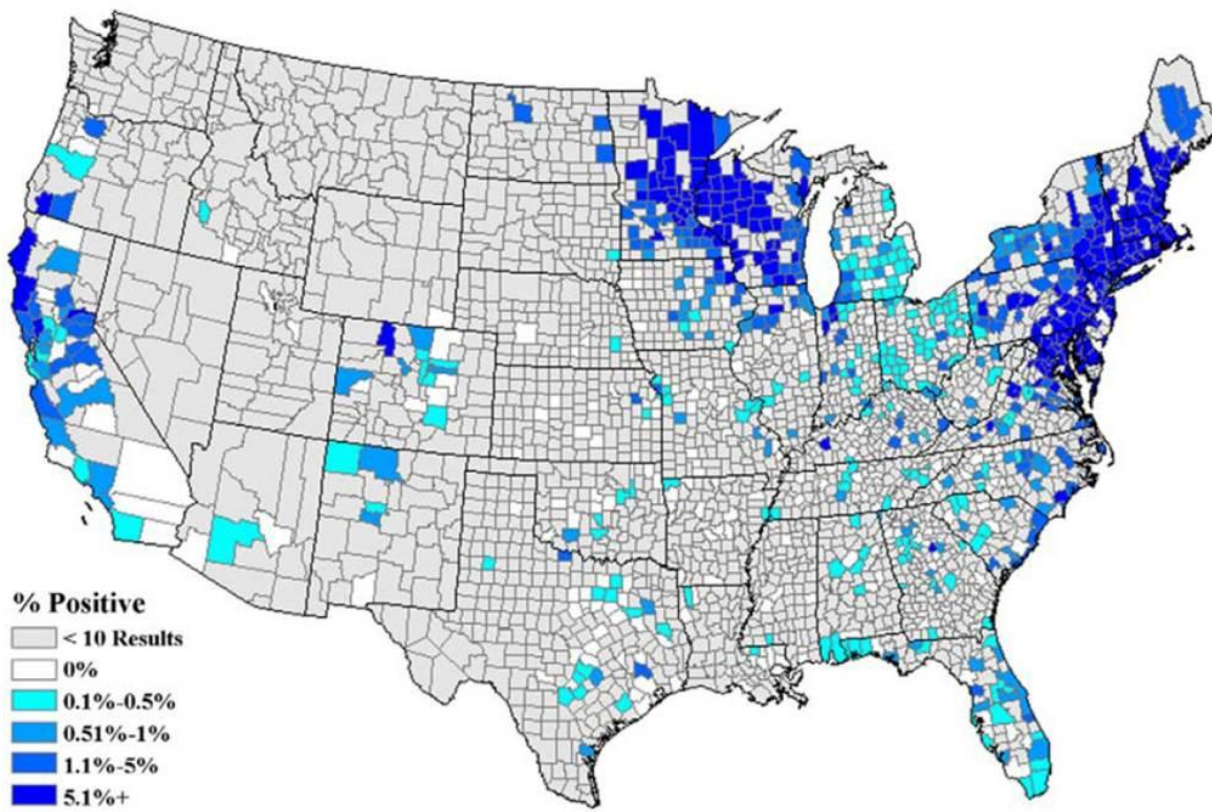
National prevalence survey



- IDEXX fax-back program
 - ▣ generated data from > 3M dogs
 - ▣ tick-borne disease data on ~ 1.5M dogs
- analyze for geographic and temporal trends in heartworm infection and tick-borne diseases
- Identify foci where active transmission is occurring



Borrelia burgdorferi in dogs



Results of serologic testing of ~ 1.5 M dogs, 2001-2008.

Bowman DD, Little SE, Lorentzen L, et al. 2009. Prevalence of vector-borne diseases in dogs in the United States: analysis of a comprehensive national database. *Veterinary Parasitology*. 160:138-48.

Results of mapping



- confirms focal geographic distribution patterns
 - ▣ endemic and hyperendemic areas
- documents areas where autochthonous transmission occurs
 - ▣ recent expansions
- opportunity to understand areas with unexpected results
 - ▣ translocation of dogs from endemic areas

Translocation of positive dogs

- positive dogs in non-endemic areas:

travel history

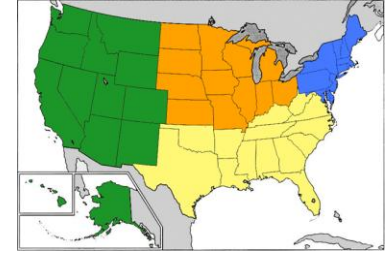
VECTOR-BORNE AND ZOONOTIC DISEASES
Volume 5, Number 2, 2005
© Mary Ann Liebert, Inc.

Research Paper

The Dog as a Sentinel for Human Infection: Prevalence
of *Borrelia burgdorferi* C6 Antibodies in Dogs from
Southeastern and Mid-Atlantic States

ASHLEE W. DUNCAN,¹ MARIA T. CORREA,² JAY F. LEVINE,²
and EDWARD B. BREITSCHWERDT¹

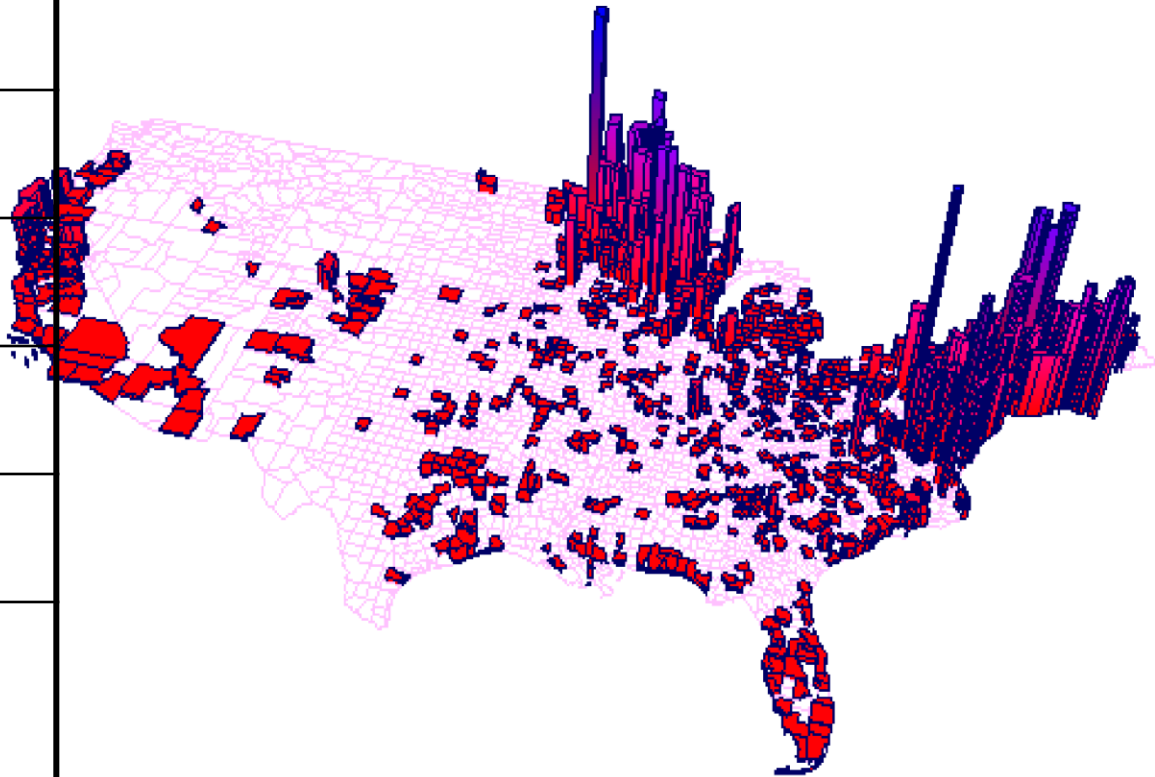
Regional averages



	<i>Bb</i>	<i>Ec</i>	<i>Ap</i>	<i>Bb/Ap</i>
NE	11.6%	0.3%	5.5%	1.4%
MW	4.0%	0.4%	6.7%	2.0%
S	1.0%	1.3%	0.5%	0.1%
W	1.4%	0.6%	4.5%	0.8%
National Average	5.0%	0.6%	4.7%	1.3%

Regional maxima

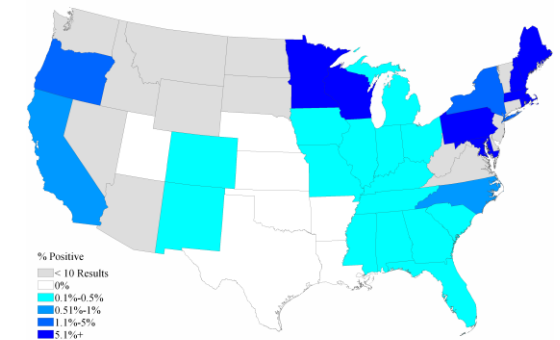
	<i>Bb</i>
NE	47.4%
MW	60.9%
S	59.3%
W	9.3%
National Average	5.0%



Hyperendemic foci of infection



- Identifying areas of high infection within relatively lower endemic areas
 - ▣ suggests intense focus of transmission occurring
- Pronounced differences between adjacent urban and exurban areas
- Important implications for veterinary and human health



% Positive

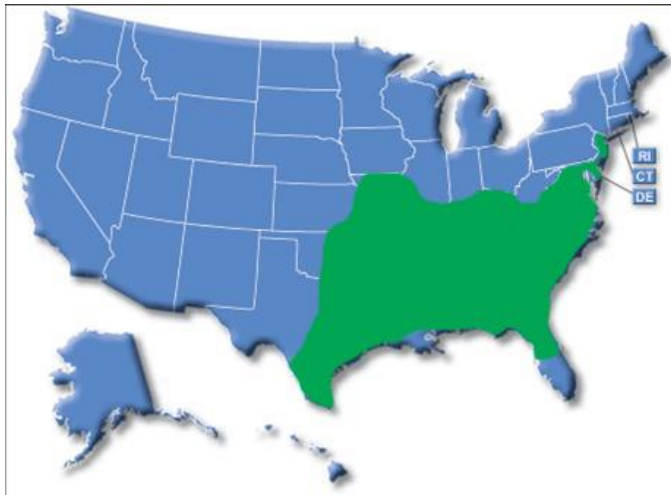
- < 10 Results
- 0%
- 0.1%-0.5%
- 0.51%-1%
- 1.1%-5%

2005-2008

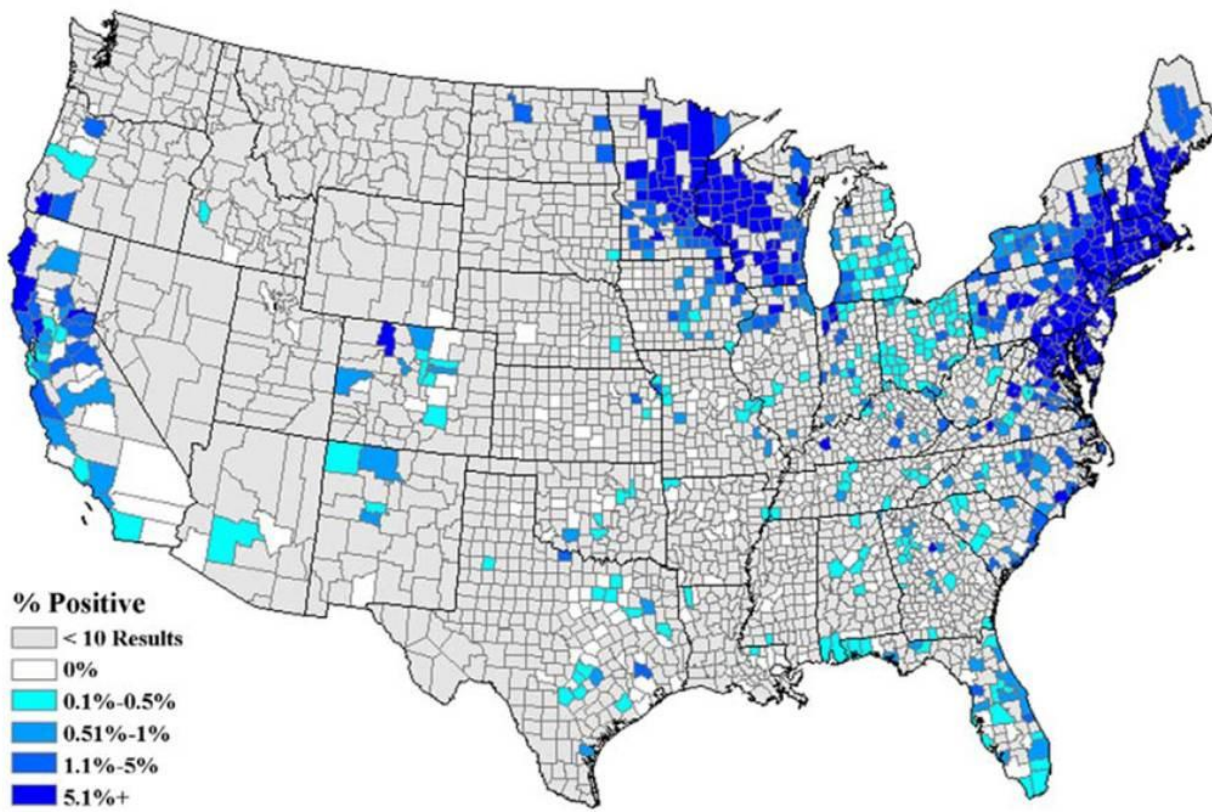


Change always comes bearing gifts.

Price Pritchett



Borrelia burgdorferi in dogs

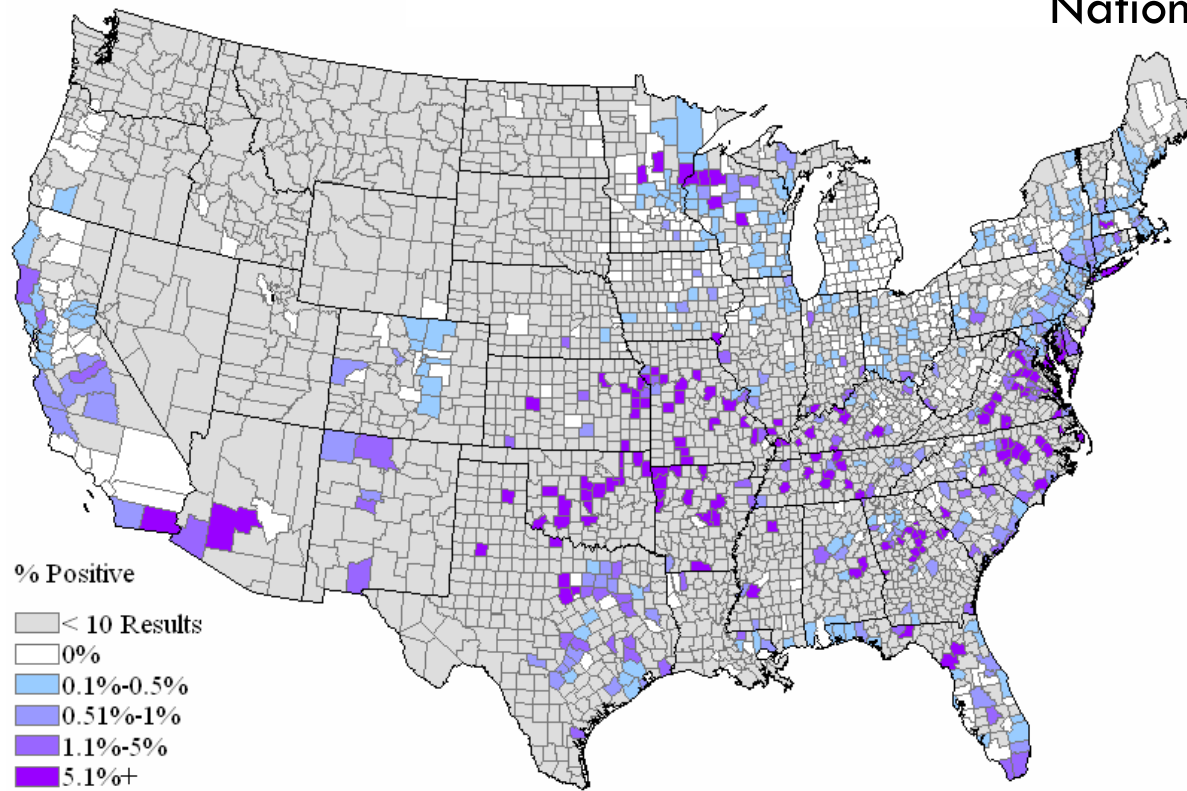


Results of serologic testing of ~ 1.5 M dogs, 2001-2008.

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Ehrlichia in dogs

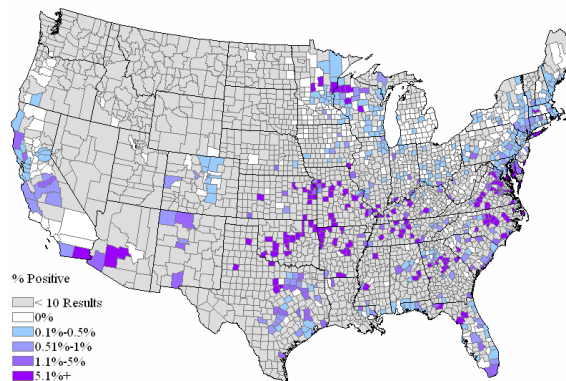
National prevalence: 0.6%



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Novel *Ehrlichia* sp.

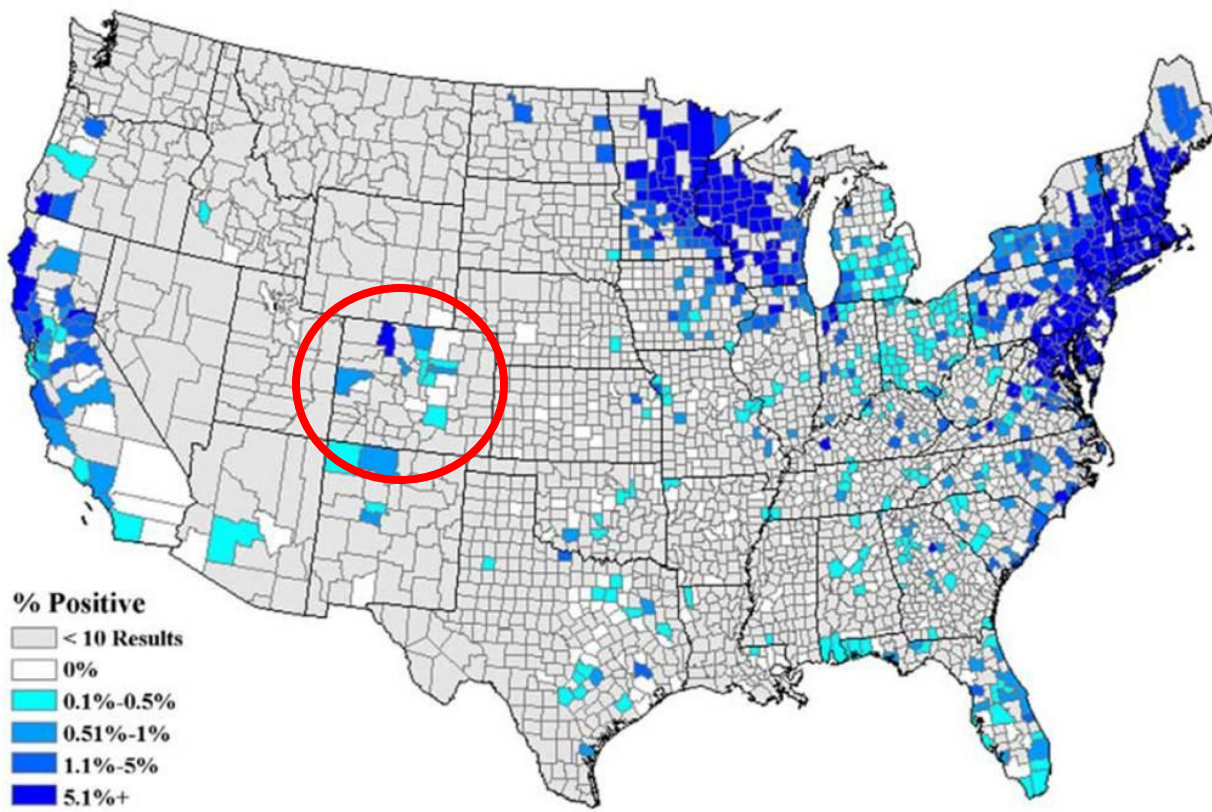


MLS: Laboratory Update
Human Anaplasmosis & Ehrlichiosis Important Update
May 11, 2010

NEW Ehrlichia Species Identified

In 2009, Mayo Medical Laboratories detected a new species of *Ehrlichia* DNA in four patients (3 from Wisconsin, 1 from Minnesota) using PCR. The unique nucleotide sequence is similar to *Ehrlichia muris*, a species not previously identified in North America. These patients infected with the *E. muris*-like agent (EML) presented with a febrile illness; two patients had a remote history of prior organ allograft. All recovered with doxycycline treatment.

Borrelia burgdorferi in dogs



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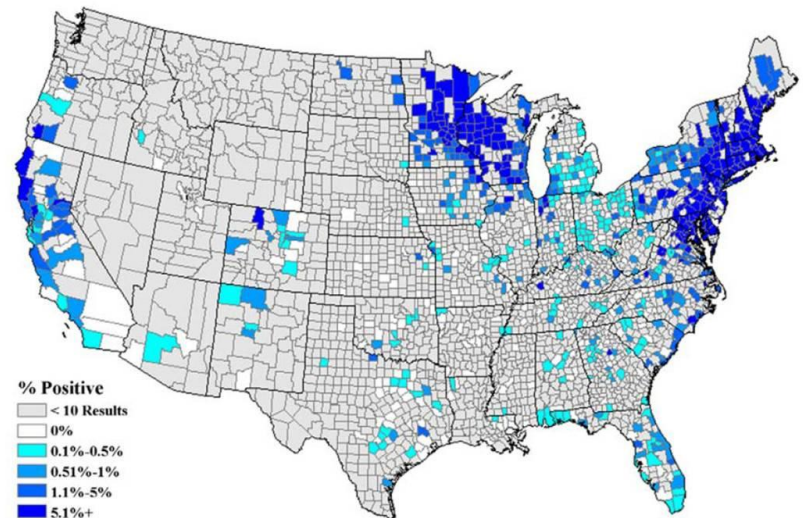
Bowman DD, Little SE, Lorentzen L, et al. 2009. Prevalence of vector-borne diseases in dogs in the United States: analysis of a comprehensive national database. *Veterinary Parasitology*. 160:138-48.

Borrelia burgdorferi in CO?

Discovery of an Enzootic Cycle of *Borrelia burgdorferi* in *Neotoma mexicana* and *Ixodes spinipalpis* from Northern Colorado, an Area Where Lyme Disease Is Nonendemic

Gary O. Maupin, Kenneth L. Gage, Joseph Piesman,
John Montenieri, Steven L. Sviat, Lorna VanderZanden,
Christine M. Happ, Marc Dolan, and
Barbara J. B. Johnson

Division of Vector-Borne Infectious Diseases, National Center for
Infectious Diseases, Centers for Disease Control and Prevention,
Fort Collins, Colorado



Conclusions

- Ticks transmit a wide array of pathogens that infect both people and dogs
- Prevention strategies, diagnostic approaches, treatment recommendations, and clinical outcomes differ between humans and dogs, and veterinarians, physicians, and pet owners should be aware of the significant differences
- Future research, such as monitoring exposure rates in dogs, should facilitate greater understanding of these infections in both dogs and people
- **It is not necessary to change. Survival is not mandatory.**

W. Edwards Deming

Acknowledgements

- Dwight Bowman
- Leif Lorentzen
- Mike Sullivan
- James Shields
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- Kelly Allen
- Steph Heise
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- Ed Breitschwerdt
- Steve Callister
- Jennifer McQuiston
- Paul Mead
- William Nicholson